MEMORANDUM

TO: Toni Jones, U.S. Environmental Protection Agency

FROM: Eastern Research Group, Inc.

DATE: November 21, 2011

SUBJECT: Summary of the Secondary Impacts of Control Options for CISWI Standards for Reconsideration Proposal

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1.0 PURPOSE

This memorandum summarizes the secondary impacts associated with control devices used to comply with the proposed emission standards for Commercial and Industrial Solid Waste Incineration (CISWI) units. Secondary impacts result from the consumption of fuel, water, and electricity and generation of solid wastes by control devices. Section 2.0 provides a background for the standards, Section 3.0 presents the secondary impact estimates associated with control devices necessary for all units to comply with the standards, and Section 4.0 presents the air emission estimates associated with the secondary impacts.

2.0 BACKGROUND

The U.S. Environmental Protection Agency, under section 129 of the Clean Air Act (CAA), is required to regulate emissions of the following nine pollutants from CISWI units: hydrogen chloride (HCl), carbon monoxide (CO), lead (Pb), cadmium (Cd), mercury (Hg), particulate matter (PM), dioxins/furans (PCDD/PCDF), nitrogen oxides (NO_x), and sulfur dioxide (SO_2).

On December 1, 2000, the EPA established new source performance standards (NSPS) and emission guidelines (EG) for CISWI units under Sections 111 and 129 of the CAA. In 2001, EPA was granted a petition for reconsideration regarding the definitions of "commercial and industrial waste" and "commercial and industrial solid waste incineration unit." Also in 2001, the United States Court of Appeals for the District of Columbia Circuit granted the EPA's voluntary remand, without vacatur, of the 2000 rule. In 2005, the EPA proposed and finalized the CISWI definition rule which revised the definitions of "solid waste," "commercial and industrial waste," and "commercial and industrial waste incineration unit." In 2007, the United States Court of Appeals for the District of Columbia Circuit vacated and remanded the 2005 commercial and industrial solid waste incineration definition rule.

On March 21, 2011, the EPA promulgated revised NSPS and EG as its response to the voluntary remand that was granted in 2001 and the vacatur and remand of the commercial and industrial solid waste incineration definition rule in 2007. In addition, the standards re-development included the 5-year technology review of the new source performance standards and emission guidelines required under Section 129. Following that action, the Administrator received petition[s] for reconsideration and identified some issues that warranted further opportunity for public comment. In addition, data were received that enabled the EPA to revise the CISWI

inventory of waste-burning kilns and energy recovery units to more accurately reflect the definition of non-hazardous secondary materials.

The EPA has developed maximum achievable control technology (MACT) floors and emission limits in the development of the proposed standards. The development of the proposed emission limits used to determine these options is discussed in more detail in a separate memorandum.[1]

3.0 SUMMARY OF SECONDARY IMPACT ESTIMATES

To comply with the final standards, facilities may need to install the following types of controls on CISWI units:

- Wet scrubbers (WS) to reduce HCl and SO_2 emissions,
- Fabric filters (FF) to reduce Cd, Pb, and PM emissions,
- Duct sorbent injection/fabric filter (DIFF) systems to reduce HCl and SO_2 emissions,
- Regenerative Thermal Oxidizers (RTO) to reduce CO emissions,
- Selective non-catalytic reduction (SNCR) to reduce NO_x emissions,
- Activated carbon injection (ACI) systems to reduce PCDD/PCDF and Hg emissions, and
- Afterburner retrofits, tune-ups, or oxidation catalysts to reduce CO emissions.

Additional electricity is required to operate the pumps and fans associated with wet scrubbers, FF, DIFF, and SNCR systems. Also, water and subsequent wastewater disposal are required to operate wet scrubbers, DIFF and SNCR systems. Activated carbon injection systems require activated carbon as well as a method to dispose of the dust produced from the ACI system. RTOs require natural gas to oxidize the carbon monoxide in the flue gas. Although afterburners require natural gas to operate, these are primarily replacing existing afterburners, so the change in natural gas consumption may be minimal, and we do not have the data to be able to estimate this change.

The algorithms used in the cost analysis provide annual cost estimates for electricity, water, and carbon requirements as itemized components of the annual costs for the control device.[2] These cost elements for the control devices anticipated to be installed to comply with the final standards were then summed up to provide an estimate of the overall costs of electricity, water and activated carbon. To estimate the secondary impact components (e.g., electricity, water, and dust from carbon), the itemized annual cost of each component was divided by the unit price of the component utilized by the algorithm. To estimate the additional annual fuel requirements for each combustion unit operating an RTO the annual operating hours were multiplied by the natural gas fuel requirement.

Two control scenarios were considered for the proposed standards:

- Compliance by additional control only, and
- Compliance or choose another method of disposal, depending on which cost was lowest.

These scenarios are described in sections 3.1 and 3.2, respectively.

3.1 Compliance by Additional Control Only

In the first scenario, each CISWI unit in all subcategories complies with the proposed MACT floor standards by installing the anticipated control devices and associated monitoring equipment.

Table 3-1 shows the estimated values for secondary impacts, by subcategory, for the "All units comply" scenario.

TABLE 3-1. Secondary Impacts for MACT Compliance

All units comply					
Subcategory	**Electricity Required (MWh/yr)**	**Water Required (gal/yr)**	**Activated Carbon Required (ton/yr)**	**Dust Produced (ton/yr)**	**Supplemental Fuel Requirements (MMft3/yr)**
ERU - Liquid/Gas	5,637	21,303,000	0	308	-
ERU - Solids	187,499	90,042,168,599	4,424	16,721	-
Incinerators	7,725	102,581,104	235	335	-
Small, remote	140	0	5	10	-
Kilns	48,624	424,226,569	5,328	5,450	1,288
Totals	**249,626**	**90,590,279,272**	**9,993**	**22,824**	**1,288**

3.2 Compliance or Alternative Method of Disposal

The second scenario entails a situation where facilities considered alternative disposal options and, where the alternative disposal methods are less expensive than adding control devices to comply with the standards, would instead cease burning waste and use alternative disposal methods. In addition to the electricity, water, and activated carbon requirements for those facilities that choose to add control devices to comply with the standards, secondary impacts also occur when alternative waste-handling methods are used. For the majority of incinerators, it would be less expensive to send waste to a landfill than to comply with the proposed emission limits (i.e., facilities would choose to shut down CISWI units). According to our estimates based on unit capacities and annual operating hours, this would result in approximately 110,417 tons per year of additional waste being sent to landfills. This would also result in subsequent landfill gas emissions from decomposition of this waste, which would likely be sent to a landfill gas flare. This gas flaring would result in emissions of NO_x and CO, with some SO_2, PM, and small amounts of mercury also being emitted. Further details on landfill emissions can be found in a separate memorandum.[3] For small, remote units, it was determined that it is generally less expensive for facilities to segregate their waste and divert the nonferrous metal and chlorinated plastic to a landfill than to landfill all of their waste. In this case, the landfilled material is considered non-digestable and will not contribute significantly to landfill emissions. While not quantified in our analysis, there are also likely to be secondary emissions associated with the transport of the waste to a landfill site. These emissions would be site-specific and depend primarily on the number of trips, type of vehicle, and distance traveled necessary to transport the waste to the landfill.

Table 3-2 shows the estimated values for secondary impacts resulting from each facility choosing the lowest-cost option for its units. Details regarding the unit-specific, lowest-cost options can be found in the compliance cost memorandum.[2]

TABLE 3-2. Secondary Impacts for MACT Compliance for Lowest Cost Options

Lowest Cost Option						
Subcategory	**Electricity Required (MWh/yr)**	**Water Required (gal/yr)**	**Activated Carbon Required (ton/yr)**	**Dust Produced (ton/yr)**	**Supplemental Fuel Requirements (ft3/yr)**	**Annual Waste Diverted to Landfill (ton/yr)**
ERU - Liquid/Gas	5,637	21,303,000	0	308	-	
ERU - Solids	187,499	90,042,168,599	4,424	16,721	-	
Incinerators	494	8,178	67	68	-	110,417
Small, remote	29	0	1	3	-	
Kilns	48,624	424,226,569	5,328	5,450	1,288	
Totals	**242,283**	**90,487,706,345**	**9,820**	**22,549**	**1,288**	**110,417**

4.0 SUMMARY OF SECONDARY IMPACT EMISSION ESTIMATES

Emission factors from EPA's eGRID[4] database were used to calculate emissions resulting from the electricity required for additional control devices, and emission factors from EPA's AP-42 emission factor document[5] were used to calculate emissions resulting from the combustion of additional fuel for RTOs. Increased electrical use from the control options will require additional fuel to be burned in power plants, resulting in emissions of CO_2 and criteria pollutants, such as SO_2, NO_x, and CO. Emissions of these pollutants (caused by increase in electricity) were estimated using EPA's eGRID database.[4] The eGRID database summarizes emissions of criteria pollutants on a per electrical usage basis (lb emitted per MW-hr), on a national average or state average basis. For this analysis the national average was used. To estimate emissions from combustion of natural gas, emission factors from EPA's AP-42 emission factor document were used.[5]

Tables 4-1 summarizes the resulting emissions of CO_2, CO, NO_x, and SO_2 from combustion of natural gas supplemental fuel and increase electricity usage for the control options analyzed for existing sources. Table 4-2 shows the resulting emissions of CO_2, CO, NO_x, and SO_2 from combustion of natural gas supplemental fuel and increase electricity usage for the lowest cost options analyzed for existing sources.

The Appendix to the secondary impacts analysis contains the spreadsheets supporting these summaries.

TABLE 4-1. Secondary Emission Impacts for MACT Compliance

	Electricity Requirements and Emissions (tons/yr)				Supplemental Fuel Requirements and Emissions (tons/yr)				Total Secondary Emissions (tons/yr)			
Subcategory	Mw-hr/yr	CO_2 Emitted	NO_x Emitted	SO_2 Emitted	Million ft^3 Natural Gas/ yr	CO_2 Emitted	CO Emitted	NO_x Emitted	CO_2 Emitted	CO Emitted	NO_x Emitted	SO_2 Emitted
ERU - Liquid/Gas	5,637	3,747	5.46	14.82	-	-	-	-	3,747	-	5.46	14.82
ERU - Solids	187,499	124,626	181.56	493.02	-	-	-	-	124,626	-	181.56	493.02
Incinerators	7,725	5,135	7.48	20.31	-	-	-	-	5,135	-	7.48	20.31
Small, remote	140	93	0.14	0.37	-	-	-	-	93	-	0.14	0.37
Kilns	48,624	32,319	47.08	127.85	1,288	77,287	54.1	64.4	109,606	54.1	111.49	127.85
Totals	**249,626**	**165,920**	**242**	**656**	**1,288**	**77,287**	**54.1**	**64.4**	**243,207**	**54.1**	**306**	**656**

a. National emission factors from Egrid[4] for EGUs.

b. Natural gas emission factors from AP-42.[5]

TABLE 4-2. Secondary Emission Impacts for Lowest Cost Option

	Electricity Requirements and Emissions (tons/yr)				Supplemental Fuel Requirements and Emissions (tons/yr)				Total Secondary Emissions (tons/yr)			
Subcategory	Mw-hr/yr	CO_2 Emitted	NO_x Emitted	SO_2 Emitted	Million ft^3 Natural Gas/ yr	CO_2 Emitted	CO Emitted	NO_x Emitted	CO_2 Emitted	CO Emitted	NO_x Emitted	SO_2 Emitted
ERU - Liquid/Gas	5,637	3,747	5.46	14.82	-	-	-	-	3,747	-	5.46	14.82
ERU - Solids	187,499	124,626	181.56	493.02	-	-	-	-	124,626	-	181.56	493.02
Incinerators	494	328	0.48	1.30	-	-	-	-	328	-	0.48	1.30
Small, remote	29	19	0.03	0.08	-	-	-	-	19	-	0.03	0.08
Kilns	48,624	32,319	47.08	127.85	1,288	77,287	54.1	64.4	109,606	54.1	111.49	127.85
Totals	**242,283**	**161,039**	**235**	**637**	**1,288**	**77,287**	**54.1**	**64.4**	**238,327**	**54.1**	**299**	**637**

a. National emission factors from Egrid[4] for EGUs.

b. Natural gas emission factors from AP-42.[5]

REFERENCES

1. "CISWI Emission Limit Calculations for Existing and New Sources for Reconsideration Proposal" Memorandum from Eastern Research Group, Inc. to Toni Jones, U.S. Environmental Protection Agency. November 3, 2011.

2. "Reconsideration Proposal Compliance Cost Analyses for CISWI Units" Memorandum from Eastern Research Group, Inc. to Toni Jones, U.S. Environmental Protection Agency. November 20, 2011.

3. "Reconsideration Proposal Baseline Emissions and Emissions Reductions Estimates for Existing CISWI Units" Memorandum from Eastern Research Group, Inc. to Toni Jones, U.S. Environmental Protection Agency. November 20, 2011.

4. EPA eGRID database eGRID2007 Version 1.1. Year 2005 summary tables located at www.epa.gov/cleanenergy/documents/egridzips/eGRID2007V1_1_year05_SummaryTables.pdf

5. U.S. Environmental Protection Agency, 1995. Compilation of Air Pollutant Emission Factors (AP-42), Fifth Edition, Volume 1: Stationary and Point Sources, Chapter 1: External Combustion Sources.